

CLAIMS

1. A cylinder operation control apparatus comprising:
 - an internal combustion engine which is adapted to operate in an all-cylinder activation mode in which all-cylinders thereof are activated, and in a cylinder deactivation mode in which at least a cylinder thereof is deactivated;
 - a lift amount changing device which is associated with the internal combustion engine, and which enables switching between the all-cylinder activation mode and the cylinder deactivation mode by changing the amount of lifts of intake and exhaust valves associated with the cylinders;
 - a lift operating device which is associated with the lift amount changing device to operate the same;
 - a cylinder activation enforcing device which is operatively disposed between the lift amount changing device and the lift operating device so as to enforce the all-cylinder activation mode as necessary; and
 - a control unit which is operatively connected to the lift amount changing device, the lift operating device, and the cylinder activation enforcing device, for controlling the operation mode of the internal combustion engine.
2. A cylinder operation control apparatus according to claim 1, wherein the lift amount changing device comprises a hydraulic variable valve timing mechanism.
3. A cylinder operation control apparatus according to claim 2, wherein the control unit is adapted to control the oil pressure for the hydraulic variable valve timing mechanism so as to suspend the operations of the intake and exhaust valves when the internal combustion

engine is placed in the cylinder deactivation mode.

4. A cylinder operation control apparatus according to claim 2, wherein the control unit is adapted to operate the cylinder activation enforcing device so as to enforce normal operations of the intake and exhaust valves as necessary.

5. A cylinder operation control apparatus comprising:

an internal combustion engine which is adapted to operate in an all-cylinder activation mode in which all-cylinders thereof are activated, and in a cylinder deactivation mode in which at least a cylinder thereof is deactivated;

a lift amount changing device which is associated with the internal combustion engine, and which is adapted to change the amount of lifts of intake and exhaust valves associated with the cylinders using an operation oil supplied from a hydraulic power source;

a cylinder activation passage connected to the lift amount changing device for placing the internal combustion engine in the all-cylinder activation mode;

a cylinder deactivation passage connected to the lift amount changing device for placing the internal combustion engine in the cylinder deactivation mode;

an oil supply passage which is connected to the cylinder activation passage and the cylinder deactivation passage for supplying the operation oil to the lift amount changing device, and which is provided with an oil supply branching passage branching therefrom;

a drain passage which is connected to the cylinder activation passage and the cylinder deactivation passage for allowing the operation oil to return to the hydraulic power source, and which is provided with a drain branching passage branching therefrom;

a switching device which is connected to the cylinder activation passage, the cylinder deactivation passage, the oil supply passage, and the drain passage, for optionally supplying

the operation oil from the hydraulic power source to the cylinder activation passage or to the cylinder deactivation passage; and

a cylinder activation enforcing device which is connected to the cylinder activation passage, the cylinder deactivation passage, the oil supply branching passage, and the drain branching passage, for enforcing the all-cylinder activation mode.

6. A cylinder operation control apparatus according to claim 5, wherein the cylinder activation enforcing device comprises: a cylinder activation port for optionally connecting the oil supply branching passage to the cylinder activation passage or disconnecting the oil supply branching passage from the cylinder activation passage; and a cylinder deactivation port for optionally connecting the drain branching passage to the cylinder deactivation passage or disconnecting the drain branching passage from the cylinder deactivation passage.

7. A cylinder operation control apparatus according to claim 6, wherein the cylinder activation enforcing device comprises a spool valve having a spool therein, the spool valve being adapted to perform the connecting and disconnecting operations between the oil supply branching passage and the cylinder activation passage, and connecting and disconnecting operations between the drain branching passage and the cylinder deactivation passage, by sliding the spool to respective predetermined positions.